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The present invention concerns a method for steering sootblowers in a boiler plant, which are individual or activatable by groups, in order to release the heat exchanger surfaces of the tank from deposits to, as well as an associated apparatus.

Boiler plants, in particular those large conventional power station blocks are subject to a more or less strong contamination as a function of the used fuel. Particularly in coal-fired power stations, in addition, with with other fuel, z. B. Claimant power stations, deposits on the Wärmetauscherflä of the boiler plant set, worsen waste off, the heat transfer and lead in such a way to a reduced efficiency of the entire plant.

For the control of this problem it is for a long time well-known to use so-called sootblowers which are operated depending upon application with water, water vapour, a gas (air, inert gas etc.). The cleaning medium used in each case is squirted from one or more nozzles on the heat exchanger surfaces and cleans these of deposits. The cleaning procedures are not accomplished continuous, but in temporal spacings, whereby large power plants exhibit a multiplicity of individual sootblowers, which are generally by groups successively activated.

In a boiler plant also simultaneous different types from sootblowers can come to the inset. From the DE-PS 22 45 702 and the DE-PS 23 07 311 is sootblowers and methods to their enterprise well-known, with which deposits at the boiler walls and tubing heat exchangers can be replaced inside a boiler plant. These sootblowers are brought in as lances the inside the tank and their nozzles after certain settings along the heat exchanger surfaces which can be cleaned are moved. With such sootblowers there are different kinds of the movement, in particular combinations of translation and rotation.

In the actual combustion chamber range, within which the heat exchanger surfaces form the generally simultaneous walls, frequently so-called Wasserlanzenbläser is used, which is described for example in the dd 2 81 468 A5. With such movable water lances by a side of the tank from the opposite wall is cleaned by moving the water jet.

There is also sootblowers with a multiplicity of blowing openings distributed over the lance length well-known, those in the kettle remains and with soot blisters translatorische motions with only small movement widths and possibly. an overlaid rotation implement.

With the well-known apparatuses the geometrical conditions are generally going by considered with the choice of the cleaning parameters that the cleaning intensity per unit area of the surface constant which can be cleaned remains. The translation and/or. Therefore necessarily constant values do not have rotation during a blowing procedure, but are adapted in their process to spacing and angle of the sootblower to the surface which can be cleaned.

Since the cleaning procedure causes the efficiency of the boiler plant by injecting the cleaning medium worsened and in addition the supply of the cleaning medium substantial costs, in particular with the purification with water vapour, and the additionally natural sootblowers themselves a wear are subject, as not activating for a long time desired, more frequently than absolutely necessarily the sootblowers. In addition it comes still that excessive purifying from heat exchanger surfaces can lead to erosion, so that the components themselves are damaged and their life are reduced. Many different attempts were made corresponding the optimization of the inset by sootblowers, as the intervals between activating individual Russbläsergruppen were specified by costs/use considerations. Such optimization procedures are for example in the EP 0,137,709 B1 and the EP 0,132,135 B1 described.

Despite various efforts to stop the cleaning intervals and other cleaning parameters optimal did not succeed in so far finding to a large extent automatically a working and the most important factors considering method to the optimal control from sootblowers to. The reason lies on the one hand in the fact that each sootblower a larger range, z. B. a whole bundle of pipes, to clean must, so that already within this range uneven cleaning efficiencies arise. Close tubes arranged at the sootblower are already damaged by erosion, if the cleaning efficiency removes for lying tubes with further yet is not sufficient. In addition an examination of the cleaning concepts used in each case was possible generally only with stop of the plant by inspection, so that the occurrence of erosion and/or the occurrence of distant deposits within the cleaning range only after long time be determined and the cleaning concept could be adapted accordingly. Schliesslic depends it also on the settings with a cleaning concept whether at all an economically optimal inset can be achieved.

Task of the present invention is therefore the creation of a method for steering sootblowers, which as carefully as possible, but although effective cleans. In particular consumption at cleaning medium is to be limited to the M necessary for an effective purification under avoidance of repeated admission of surfaces with cleaning medium, already cleaned. Also the creation of an appropriate apparatus is task of the invention.

For the solution a method after the claim 1 and an apparatus serve this task after the claim 9. Favourable arrangements are into that in each case indicated to dependent claims.

A substantial feature of the invention is that from the dominant method it is deviated that with each activate the

sootblower the cleaning parameters during the whole cleaning procedure (blowing interval) constant remain and/or. straight so variie becomes, as is necessary for a constant cleaning intensity per cleaning surface, and generally these parameters also for a multiplicity of cleaning procedures to be kept alike. Meis are operated even different groups by sootblowers with same parameters, in particular with constant pressure. This leads automatically to the fact that at least a part of the cleaned surfaces is than necessarily cleaned more and from it much cleaning medium spent will be able unnecessarily to result and to erosion damage. In contrast to it not only the sootblowers can be activated received from a central control unit, but individually and/or with the present invention. also by groups their respective current cleaning parameters of the control unit.

During a usual cleaning procedure with a cleaning intensity given in advance per unit area it is cleaned which bedeut that the sootblowers so controlled become that they clean all them assigned in each case to cleaning surfaces approximately with the same intensity, which however in each case approach is attainable. As variable parameters for the adjustment of the cleaning intensity in particular the pressure of the cleaning medium, the speed, with the blast cleaning over the surfaces which can be cleaned moved and the repeating frequency, D stand themselves. h. the number of cleaning passages b a cleaning procedure, for the order.

One assumes drove a complete purification a certain combination of these parameters; in particular max mark pressure, minimum speed and maximum repeating frequency are necessary, can at a regular purification with other parameters be worked according to invention, which lead to a smaller cleaning intensity per unit area. While with the target to accomplish a maximum cleaning always reliably some patches too strongly are surely cleaned and thus to an erosion exposed and in addition much cleaning medium spent becomes unnecessary, the purification with decreased cleaning intensity does not have these disadvantages. There is however the risk that in the course of long Betriebszei in subranges unwanted deposits collect, if the cleaning intensity is substantially too low selected. Natural one is also never reached with an incomplete purification the highest efficiency of the plant, however it is completely insignificant for the average efficiency of the boiler plant which can be determined about the process from many cleaning cycles to whether at certain times the maximum efficiency is reached or not, as long as only the average efficiency has a sufficient high value. This can be guaranteed by suitable choice of the cleaning cycles also with the individually controlled intensity according to invention of the cleaning.

Preferred measured values from the boiler plant and/or from it computed physical values, which can give information on the success of a cleaning procedure, are observed during and after the cleaning procedures and in correlation to with the Reinigun used parameters set. In the simplest case z can. B. the exhaust gas temperature during and after the purification to be measured, in order to give a measure for the success of the purification. Since generally at a boiler plant a great many measured values are available, very many more exact statements can be made by observation and linkage of the available measured values. It is possible to store the significant measured values or values available after a maximum cleaning as reference values and to then compare with these the values obtained after a regular purification. This is a completely substantial point of the present invention, there only by reliable reference values, itself if necessary. at changes of the boiler plant in run a long period of operation adapt, a reliable statement about it becomes possible whether a regular purification approximates a maximum cleaning or only very much smaller cleaning efficiency unfolded. It is to be pointed out that it is in principle not possible ohneh to clean a boiler plant in such a way by sootblowers that she reaches her new condition completely or almost. A part of the heat exchanger surfaces is always unattainable for the purification; so that there the inevitably forming deposits always lead apart from other changes of the boiler plant to long-term offsets of the reference values, which with past cleaning concepts could become hardly balanced.

In particular the presence of reference values adapted to the respective plant condition makes possible it to release and with suitable parameters accomplish the regular cleaning procedures very purposeful. The release can take place in particular if the measured and/or computed values deviate from the stored reference values by a given minimum amount or natural, if a certain maximum time is exceeded since the last purification.

The observation of cleaning success on the basis measured and or computed values, z. B. the exhaust gas temperature; permitted with it also a ?learning? mode of operation of the system. There the regular cleaning generally quite frequently, z. B. all four to twelve hours, to be accomplished, it is possible to vary the cleaning parameters with the regular cleaning procedures and to observe the effects on the cleaning efficiency. A goal should be it about of stopping the parameters in such a way that the effect of a regular purification in a certain tolerance volume holds itself below the effect of a maximum cleaning, whereby simultaneous those are to be found technically or economically most meaningful parameter. Adherence to the desired cleaning volume is reached by the fact that during in relation to a maximum cleaning to small cleaning efficiency parameters are increased toward a stronger cleaning efficiency for the next purification, while they are changed with too close A of the maximum cleaning efficiency a lying effect in the direction of a weaker purification. If the cleaning efficiency lies within the desired range, then the cleaning parameters can be otherwise varied, in order to collect and store information about the effects of the individual parameters on the cleaning efficiency than empirical values and for an optimal cleaning guidance use with successive regular cleaning. So it can be for example determined which functional connection exists for a certain sootblower in a certain component between D cleaning efficiency and the individual parameters, whereby then for the cleaning time, the steam consumption, which wear of the sootblower and/or the erosion of the heat exchanger surfaces of most favorable values can be selected.

The described proceeding can be accomplished for each individual sootblower or for each group by sootblowers, whereby in each case different than favorably determined parameter combinations, parameter processes and Reinigungsinteraalle to arise being able. Natural ones can be overlaid the parameters stored for the rotation-more moderate cleaning still with a function, which shows the degree of the contamination as a function of the time, concomitantly adequate regular cleaning in different time intervals and with different modes of operation and load conditions of the boiler and/or. different fuel to be accomplished can.

The proceeding according to invention has special advantages with boiler plants, in which regulated cooling water is injected for avoidance vo temperature rises at certain heat exchanger surfaces into the steam stream. If one would clean these heat exchanger surfaces maximally, then this would have generally only as a consequence that more cooling waters per time unit it would be injected whereby economically rather a disadvantage occurs as an advantage of the purification. Straight one into this felling is not meaningful a regular maximum cleaning, since a certain quantity of

deposits reduces even cooling water consumption. Therefore it for such heat exchanger surfaces will be more favourable to release a cleaning procedure only if the injected cooling water quantity per time unit falls below an amount given in advance and/or a cleaning procedure to omit, if the injected cooling water quantity per time unit exceeds an amount given in advance. Above all however an offset of the tolerance volume toward smaller cleaning efficiency is possible, so that no complete purification is accomplished in each case.

A further completely substantial advantage of the present invention is in the fact that the observation of the cleaning efficiency can be used not only for following cleaning, but even fü the event running in each case. If the measured values result in for example that a sufficient cleaning already took place at bringing a sootblower in into the boiler, then this can do with increased speed and/or decreased pressure again driven out which a significant reduction of consumption at cleaning medium is meant. Natural one must always the minimum throughput at cleaning medium in the sootblower, necessary for the cooling, maintains to become.

Perhaps it is even possible to regulate depending upon the kind of the parts which can be cleaned the cleaning parameters as a function of the respective place of the sootblower or on the time since beginning of the activation. Also a regulation of the cleaning efficiency compared with a reference curve as a function of the place of the sootblower is possible. So purposeful contamination with certain contamination profiles can be cleaned over the drive of a sootblower, which admits from experience or by preceding measuring is, with according to adapted profiles of the cleaning parameters.

As is still more near described on the basis the design, also an apparatus serves 9, 10 and 11 in accordance with the claims for the solution of the tasks posed.

Embodiments of the invention and their surrounding field are more near described on the basis the schematic design, to show

Fig. 1 a boiler plant with associated control device for sootblowers;

Fig. 2 schematically the heat exchangers of a boiler plant with associated Russbläsergruppen, measuring points and control unit of the sootblowers and

Fig. 3 the process of the exhaust gas temperature of a boiler plant as a function of the time with and between cleaning procedures.

Fig. 1 shows schematically a boiler plant 1 with wall heat exchangers 2 in the range of the hearth and tubing heat exchangers 3 in the following part of the boiler plant. Exemplarily for a multiplicity of sootblowers a sootblower 4 is represented, which squirts a cleaning medium 5 in the enterprise on from it to cleaning heat exchanger surfaces. Each sootblower is propelled by a variable drive 6 and supplied via a pressure-regulated lead 7 with enterprise with the cleaning medium. The pressure regulation can be separately present both at each sootblower 4 or in a collecting inlet for one or more group (n) by Russbläsern.Da usually only a sootblower 4 or a group of neighbouring sootblowers 4 simultaneous is however only activated, can the expenditure for pressure controlling means be kept small, since in and the same pressure controlling mean by programmed setpoint input to each individual sootblower with another pressure can supply. It is still possible to adjust by individually adjustable choke coils at each sootblower 4 possible differences between simultaneous claimant sootblowers. In the boiler plant 1 many measuring instruments 8 are arranged, in particular measuring instruments for temperature; Pressure, throughput etc. . In the range of some heat exchanger surfaces a cooling water injection can be intended 9. Central control unit 10 receives 13 measured values over holding wires from the measuring instruments 8 and over further data lines 14 additional information, which can be entered perhaps also manual, over fuel, load conditions and other operatingrelevant data. Over control lines 15, 16 the control unit 10 with the variable drives 6 stands and the pressure controlling mean 7 in connection. A memory 11 contains the current cleaning parameters for each sootblower 4 and/or. each Russbläsergruppe. A comparator 12 contains reference data and empirical values, which can be compared with current cleaning parameters and measured values. A computer module 17 can contain in an extended embodiment a simulation model of the boiler plant 1, with whose aid cleaning procedures before its execution simulated and on the basis of economic and technical criteria can be evaluated, so that the actual execution must only take place, if the use is larger than the technical and economic disadvantages.

Fig. its interconnecting shows 2 among themselves in schematic display the heat exchanger arranged in a boiler plant 1 and. It concerns a typical tank of a main power station. The walls of the firing area contain (winding) heat exchanger 2, which serves for the evaporation of water and for the superheating of the developing vapor. Behind it existing (tubing) heat exchanger 3 is arranged, those as high pressure superheaters inside the boiler plant would separate usually from many tubes; Intermediate superheaters and as economizers are trained finally. Several tubing heat exchangers 3 shown with cooling water injection downstream 9 are further. Generally all stages of the boiler plant are equipped with measuring devices to the enterprise, so that the measured values of pressure P, temperature T and throughput quantity of M in many places are available. These and other measured values can be supplied over holding wires 13 and data lines 14 of the central control unit 10 and evaluated there, be served in particular in a computer module 17 for the simulation of the boiler plant 1. The central control unit stands thereby with a memory 11 for cleaning parameters and a comparator 12 with reference data and empirical values in connection. Over control lines 15, 16 can be headed for drive and pressure-regulated lead of cleaning medium for certain sootblowers 4, if an activation is to take place. The central control unit 10 steers both into the tank 1 retractable the sootblower 4 and possible, in Fig. it is still mentioned 2 not represented water lances for the wall heat exchangers within the range of the Feuerraumes.Es that as additional information for the central control unit further measured values about the fuel, the water content of the fuel, the oxygen in the exhaust gas, the exhaust gas temperature etc. to be transmitted can. Also measured values from sensor systems to the direct identification of deposits at heat exchanger surfaces can be along-used, in order to increase the accuracy of the control. When particularly favorably has it also proven, the steam overheating in the separation bottle 18, into the waters and vapor to be separated to measure and to win from this a more exact statement about the condition of the wall heat exchangers of the furnace.

Fig. schematically substantial Merkinale of the method according to invention describes 3 on the basis a diagram, which the course of the exhaust gas temperature of a boiler plant forwards; while and to cleaning procedures points. First the

process begins exhaustanneals during a maximum cleaning procedure, which is terminated at the time t0. At this time the regarded heat exchanger surfaces are so cleaner; how this is maximally attainable with the existing sootblowers, so that as reference the temperature TRef results. It is to be considered that in reality because of the multiplicity of the successively operated sootblowers ranges of the boiler plant get 1 dirty again, while others are still cleaned. To that extent in the following the described points serve the idealized description of a typical condition after completion of the purification rise the exhaust gas temperature slowly, since the heat exchanger surfaces are covered lan with deposits and the efficiency of the tank decrease. With reaching a given maximum temperature Tmax, which is to have a minimum distance amine to the reference temperature TRef, or already in former times due to other trigger criteria a regular cleaning procedure is released, which is terminated at the time T1. The values given in the memory for current cleaning parameters led to it that the heat exchanger surfaces which can be cleaned were not completely cleaned, however so that those does not fall below exhaust temp advice a certain minimum distance Smin of the reference temperature Tref and Smax does not exceed a certain maximum distance. From the time T1 the exhaust gas temperature rises on, until because of reaching Tmax cleaning procedure is released. This cleaning procedure is terminated at the time t2, whereby it shows up that due to any influences the desired maximum distance Smax to the reference temperature TRef is exceeded. The current cleaning parameters in the memory are therefore changed in such a way that during the next cleaning procedure a more intensive purification takes place. The exhaust gas temperature actually is at the time T3, D. h. after termination of the next cleaning procedure again in the given temperature range between the minimum clearance Smin and the maximum distance Smax of the reference temperature TRef.Der here on the basis the exhaust gas temperature described event can be accomplished very many more sensitiver for individual heat exchanger surfaces on the basis the measured values in the range of these heat exchanger surfaces the available, however the principle remains the same. One sees on the basis the chart also that the average exhaust gas temperature T by suitable choice of the maximum temperature Tmax, with which a cleaning procedure is released, and which can be stopped values for Smin and Smax to any value above the reference temperature TRef, so that the average overall efficiency of the plant does not have to be smaller with the method according to invention than with the lead-through of maximum cleaning with each purification, although after the method according to invention the Verschwendung can be avoided from vapor to the purification of already deposit-free surfaces as far as possible.

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Altogether the present invention makes the purposeful inset possible of individual sootblowers or Russbläsergruppen with individual in each case cleaning parameters, in order to specify the costs of each cleaning procedure to minieren and the cleaning intervals in such a way for each sootblower or each Russbläsergruppe that the total costs for the plant enterprise are as small as possible.